UNITED NATIONS
UNEP

EP

**UNEP**/MED WG.592/4

**United Nations**
**Environment Programme**
**Mediterranean Action Plan**

Distr.: Limited
07 May 2024

Original: English

Meeting of the Ecosystem Approach Correspondence Group on Monitoring (CORMON) Biodiversity and Fisheries

Videoconference, 6-7 June 2024

**Agenda Item 3: Development of EcAp Ecological Objectives**

**3.2. EO4: Marine food webs**

Way forward to develop IMAP common indictors for the Ecological Objective 4 on Marine Food Webs under the Barcelona convention.



SPA/RAC
Tunis, 2024

**Disclaimer:**

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Environment Programme/Mediterranean Action Plan concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The Secretariat is also, not responsible for the use that may be made of information provided in the tables and maps of this report. Moreover, the maps serve for information purposes only, and may not and shall not be construed as official maps representing maritime borders in accordance with international law.

# Note by the Secretariat

The Contracting Parties (CP to the Barcelona Convention adopted (CoP 19, Athens 2016) the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) (Decision IG.22/7) within the Ecosystem Approach (EcAp) process. The IMAP requirements focus on agreed Ecological Objectives (EOs) and their related common indicators.

The current IMAP covers with agreed common indicators the ecological objectives related to biodiversity (EO1), non-indigenous species (EO2), eutrophication (EO5), hydrography (EO7), coast (EO8), contaminants (EO9), and marine litter (EO10). Ecological objectives for marine food webs (EO4) and sea-floor integrity (EO6) are not yet included in the IMAP. They were discussed in the early stages of the EcAp implementation process, with initial proposals made in 2013 for a description of Good Environmental Status (GES), associated indicators and related targets (UNEP/MAP, 2013b). However, it was agreed at the time that EO4 and EO6 needed further development, considering the lack of data and the knowledge gaps on these two topics in the Mediterranean Sea region.

As a first step towards the development of EO4 on marine food webs, A desk review study was elaborated during the biennium 2022-2023 to inventory data sources, best practices, and methodologies for monitoring and assessing marine food webs in the Mediterranean.

The present document summarises the main outcomes of desk review study to inventory data sources, best practices, and methodologies for monitoring and assessing marine food webs in the Mediterranean (UNEP/MED WG. 592/Inf.3) and provide the way forward further develop the IMAP Ecological Objective 4 on marine food webs under the Barcelona Convention.

**Way forward to develop IMAP common indictors for the Ecological Objective 4 on Marine Food Webs under the Barcelona convention.**

1. The Contracting Parties (CPs) to the Barcelona Convention agreed to implement the Ecosystem Approach (EcAp) process. In their 19th COP (Athens 2016), the CPs adopted the Integrated Monitoring and Assessment Programme of the Mediterranean Sea (IMAP) (Decision IG.22/7). Regarding Biodiversity component, the current IMAP only covers the common indicators of the Ecological Objectives (EO) related to biodiversity (EO1), non-indigenous species (EO2) and harvest of commercially exploited fish and shellfish (EO3).

2. The ecological objective 4 (EO4) on marine food webs ("Alterations to components of marine food webs caused by resource extraction or human-induced environmental changes do not have long-term adverse effects on food web dynamics and related viability") and sea floor integrity (EO6) are not yet covered in the IMAP as they need further development (i.e., proposals of indicators, Good Environmental Status (GES) description and related targets of EO4 and EO6 were discussed in the early stage of the EcAp process implementation. However, it was agreed that these 2 EOs needed further work considering the lack of data and knowledge gaps on marine food webs and sea floor integrity in Mediterranean ecosystems).

3. In order to be in synergy with the EU Marine Strategy Framework Directive (MSFD) in terms of monitoring of the ecosystem components and assessment of GES in the Mediterranean Sea, the need of a full set of common indicators related to marine food webs was ascertained.

4. Monitoring marine food webs is of utmost importance, particularly in the face of climate change-induced disruptions. Indeed, alterations to components of these webs resulting from resource extraction or human-induced environmental changes do not come without long-term adverse effects on food web dynamics and related viability. This vigilance is especially crucial in the context of the Mediterranean, where severe impacts on fishing and biodiversity are already evident.

~~5.~~ As a first step towards the development of EO4 on marine food webs, SPA/RAC has initiated a desk review study to inventory data sources, best practices, and methodologies for monitoring and assessing marine food webs in the Mediterranean (UNEP/MED WG. 592/Inf.3). The desk review consist of the following sections: scientific publications; existing and potential data sources; methodologies for monitoring and assessment (under the MSFD and other EU sea conventions, such as OSPAR, HELCOM); relevant ongoing/concluded initiatives/projects at regional, sub-regional, or national levels; regional/national institutions or key experts working on monitoring and assessment of food webs in the Mediterranean; knowledge gaps.

6. This desk review shows that a huge number of scientific publications (both academic and grey literature) exists about the application of methods for the study of marine food webs in the Mediterranean. The topic has been extensively explored in the last few decades, with special reference to the diet of single species and, to a much lesser extent, to the analysis of the whole food webs.

7. Existing and potential data sources for Mediterranean food webs offer valuable insights despite their limitations. Various methodologies are used for monitoring and assessing marine food webs, crucial for understanding ecosystem health and fulfilling objectives outlined in the Barcelona Convention, include traditional methods like stomach content analysis, providing a snapshot of dietary habits. Each method has its advantages and limitations, emphasizing the importance of employing a combination of approaches to comprehensively study marine food webs and assess their ecological status.

8. Several indicator proposals have been put forward for Ecological Objective 4 (EO4). Gascuel et al. (2005) suggested the Trophic Spectrum of total consumer biomass as an indicator of trophic structure in a fisheries context. The Mean Trophic Level (MTL) or Mean Trophic Index (MTI) has

been used to assess the average trophic position of a species assemblage in the food web (Pauly et al. 1998). Rountos et al. (2015) proposed the mean trophic level of predator consumption (mTLQ) and used it alongside MTL. Other indicators have been identified for Descriptor 4 (D4) of the MSFD, such as the performance of key predator species, biomass of large fish, and abundance trends of selected groups and species. Tam et al. (2017) put forward a list of 9 operational indicators, while Safi et al. (2019) used Ecological Network Analysis to propose another set of indicators. Additionally, Thompson et al. (2020) suggested a single indicator based on feeding guild assessment, and Machado et al. (2021b) advanced four food web indicators.

9. Various ecological models, such as stable isotope-based ones, help assess marine food webs. Trophic Spectrum and Mean Trophic Level were suggested as indicators. These models, from linear mixing to Bayesian ones like MixSIAR, aid in understanding ecosystem changes. OSMOSE and StrathE2E explore biodiversity's role, while best practices by Phillips et al. (2014) and cumulative trophic patterns by Link et al. (2015) offer insights. The Ecopath system, including Ecopath, Ecosim, and Ecospace, is widely used for ecosystem assessments, with notable Mediterranean case studies like Coll & Libralato (2012) and Steenbeek et al. (2013).

10. The Marine Strategy Framework Directive (MSFD) sets out objectives for achieving and maintaining good environmental status in the marine environment, including Descriptor 4 (D4) focusing on food webs. Various indicators, such as those related to trophic guilds and diversity, have been identified to assess food web status. However, D4 poses challenges due to the complexity of marine ecosystems, leading to the development of ecological models and discussions around indicator selection and enhancement of their use, particularly in regions like the Baltic Sea.

11. OSPAR is dedicated to advising on fulfilling MSFD objectives within its area, conducting thematic assessments, including food webs, with common indicators like size composition in fish communities, change in average trophic level of marine predators, and proportion of large fish. OSPAR has initiated pilot assessments in the Baltic using Ecological Network Analysis, feeding guild assessments, and trophic level changes of marine consumers.

12. HELCOM, has established an expert group on food webs (EG FOODWEB) within its biodiversity working group (WG BioDiv) to develop quantitative, indicator-based assessments supporting MSFD objectives. The expert group contributed to the 2016-2021 HELCOM Holistic Assessment (HOLAS 3), detailing the methodology for assessing MSFD indicators D4C1 and D4C2 using the Ecopath with Ecosim model (EwE). However, a quantitative evaluation of the Baltic Sea's food web status remains challenging due to a lack of harmonized data and regionally agreed-upon indicators, as noted in the HOLAS 3 assessment.

13. Several research projects and initiatives exist in Europe concerning the assessment and monitoring of marine food webs. However, the Mediterranean region appears to be less active in leading such projects compared to other regions where food web studies are relatively recent and less developed, despite the production of several scientific papers on Mediterranean case studies. Significant gaps exist in data collection, reliable indicators, and setting thresholds, hindering the establishment of common targets and harmonized monitoring initiatives.

14. Key gaps identified include uncertainties regarding top predator productivity, inadequacy of size-based indicators, poor reliability of abundance trends, lack of data on feeding habits, need for adapting operational indicators, and scarcity of ecosystem-based indicators versus single species-focused ones. Long-term effects of global change, impacts of invasive alien species, nutrient changes, habitat loss, and baseline data deficiencies further challenge food web assessment. Additional gaps encompass limited trophic level estimations, lack of data on invertebrates and non-indigenous species, temporal and spatial coverage limitations, and uncertainties in assessing the impact of future changes on food web structure and function.

15. Given the importance of monitoring marine food webs, especially considering disturbances induced by climate change, SPA/RAC will continue to develop IMAP Ecological Objective 4 on marine food webs, drawing on the results of the desk review study as provided for in the SPA/RAC work program for 2024-2025.

16. To do so, it is proposed to: (i) complete the directory of specialists, laboratories, institutions, and organizations involved in working on EO4, initiated in the desk review study; (ii) update and complete the lists of projects conducted at national and regional levels on marine food webs that could contribute to the development of EO4. For this purpose, a questionnaire will be prepared by SPA/RAC and sent to contracting countries to collect the necessary information.

17. To ensure alignment with the European Union's Marine Strategy Framework Directive (MSFD) regarding ecosystem component monitoring and Good Environmental Status (GES) assessment in the Mediterranean Sea, it is proposed to hold a discussion to explore the possibility of involving non-EU Mediterranean experts and SPA/RAC in the MSFD's expert group on food webs.

18. To ensure effective development of EO4 and its integration with the other existing ecological objectives, the following approaches could be undertaken:

a) Zooplankton and phytoplankton are essential elements that sustain the organisation of food webs and pelagic populations, the development of indicators for EO4 could be addressed by the Multidisciplinary group of experts when advancing in the development of the indicator using phytoplankton and zooplankton for pelagic habitats

b) The development of Ecological Objective 3 (EO3) concerning the harvesting of commercially exploited fish and mollusks, including the refinement of its common indicators should be take into consideration the link between EO3 and EO4 and provide input to be given due consideration in the development of EO4.